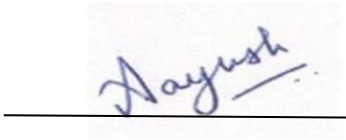
CERTIFICATE BY GUIDE

Certified that **DR. KOTIAN SWATI SHARATHKUMAR,** is a Bonafide post-graduate student in the department of Oral and Maxillofacial Surgery in M. M. College of Dental Sciences and Research, Mullana, District Ambala, Haryana and is registered with M. M. (Deemed to be) University, Mullana, Ambala. He shall carry out genuine, scientific research work on his dissertation project on **"Comparative Evaluation of irrigation with Normal Saline vs Normal Saline mixed with Benzydamine during the Surgical Removal of Impacted Mandibular Third Molar: A Prospective Clinical Study"** under our direct supervision



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INTRODUCTION

Modern day diet comprising processed & refined food with high sugar leads to high incidence of dental caries. Negligence and lack of awareness about early preventive oral health checkup leads to increased incidence of dental extractions at young age.

Post dental extraction, healing of the extraction socket takes about 3-4 weeks. In this duration, resorption of the alveolar bone occurs leading to a change in the dimensions of its height and width. According to Ashman et al, the alveolar bone resorption after extraction of tooth is about 40% to 60% of alveolar ridge volume before extraction in the first six months [1]. Following extraction 2–4.5 mm of vertical and 5-7mm in horizontal bone resorption has been reported.[2] To combat this problem of extensive resorption and unavailability of sufficient alveolar ridge space, the need for preservation of extraction sockets has increased showing promising results therefore easing the practitioner's dilemma of prosthesis planning for their patients.

Alveolar socket preservation can be done with the help of different types of grafts (autograft, allograft, xenograft), scaffolds (polymeric, ceramic, metallic types), signalling molecules and cells (osteoblasts and fibroblasts) which are the three primary elements of the healing process that encourage the regeneration of certain tissues, especially in the reossification of cavities and bony deformities.[3]

In France, PRF was first identified as an agent promoting the chemotactic migration of human mesenchymal stem cells to the injury site by Choukroun et al.[4] Platelet-rich fibrin (PRF) is produced by centrifuging autologous blood without the use of anticoagulants.[5] It contains growth factors and platelet-rich concentration, which promote healing and are essential for micro vascularization and cell migration in the extraction socket after extraction.[6] The ability of platelets to regenerate was discovered in 1974, and Ross et al. were the first to characterise platelet growth factor. Growth factors are triggered during spontaneous wound healing for bone repair after platelets trapped in the fibrin matrix are activated. This triggers the mitogenic reaction in the bone periosteum.[7]

PRF is utilised in oral and maxillofacial surgery for sinus lift treatments, implant procedures, alveolar osteitis, extraction sites, and cyst enucleation procedures.[8]

Collagen plug has become a material of interest and in many studies, it has proven to be useful in the preservation of alveolar sockets. Collagen plug is mainly made from type I collagen derived from bovine Achille's tendon. Type I collagen is extensively found in the body – bone, cartilage, ligaments, tendon as well as the skin which is why a derivative from such a source would not only be safe but also useful as it would act as an osteoconductive material which shall not only lead to new bone formation but angiogenesis as well in such sites where the surgeon wants the socket to be preserved.

Collagen plug prevents intrusion of soft tissue into the socket, therefore proving to be an aid in maintaining the dimensions of the socket. Such a material helps in clot stabilisation and protects the wound postoperatively.

Combining Collagen plug with PRF in socket preservation can enhance the regeneration capacities of collagen plug which might lead to better results. In this study we will be comparing efficacy of Collagen plug alone and collagen plug along with PRF for socket preservation.

AIM AND OBJECTIVES

AIM:

To study the efficacy of collagen plug vs PRF with collagen plug for socket preservation in mandibular molar region.

OBJECTIVES:

- To compare the regenerative potential of collagen plug alone and PRF with collagen plug.
- To evaluate the quality & quantity of bone formation.

REVIEW OF LITERATURE

1- **Tsai CH et al (2019)** Platelet-rich fibrin (PRF) is a second-generation platelet concentrate prepared without anticoagulants and supplemented with platelets and growth factors, albeit its biological effects on periodontal cells are not fully known. PRF's effects on human gingival fibroblasts, periodontal ligament cells, oral epithelial cells, and osteoblasts were assessed in this study. PRF dramatically increased the proliferation of gingival fibroblasts, osteoblasts, and periodontal ligament cells while suppressing the growth of oral epithelial cells, but it had no effect on cell survival. Additionally, these cells demonstrate adherence to PRF surfaces. The results support PRF's possible role in periodontal regeneration by showing that it has cell type-specific effects.

2- **Jeyaraj PE et al (2018)** Surgical removal of impacted mandibular third molars is usually accompanied with postoperative pain, oedema, trismus, and delayed bone healing. In order to assess the impact of autologous platelet-rich fibrin on healing, 60 patients were randomly assigned to a PRF group and a control group in this prospective study. In comparison to controls, the PRF group showed considerably earlier bone fill and reossification of the extraction socket, quicker, problem-free soft-tissue healing, and decreased postoperative morbidity. These results imply that adding PRF to third molar extraction sites promotes bone regeneration and soft-tissue healing while also improving postoperative recovery.

3- **Moraschini V et al (2015)** The impact of autologous plasma concentrates on extraction socket preservation was evaluated by a review of recent research. Four relevant studies with 102 extractions in 82 patients that were published between 2010 and 2013 were found by a thorough search of the MEDLINE/PubMed and CENTRAL databases between October 2013 and February 2014. Quantitative analysis was not feasible due to considerable variation in research design, follow-up, surgical techniques, and plasma preparation methods. Although there is currently no proof that plasma concentrates are beneficial for hard-tissue regeneration, the results indicate that they improve soft-tissue healing and epithelialization and lessen postoperative pain and discomfort.

4- **Borie E et al (2015)** A key area of clinical research is the creation of bioactive surgical adjuncts to reduce inflammation and hasten recovery. A natural, low-risk alternative with good clinical results is platelet-rich fibrin (PRF). The preparation, benefits, and drawbacks of PRF are highlighted in this review of recent research. PRF provides a minimally invasive method with a wide range of applications in dentistry and medicine, offering dependable and satisfying healing outcomes whether used either alone or in conjunction with other biomaterials.

5- **Pagni G et al (2012)** After tooth extraction, the alveolar ridge inevitably undergoes remodelling, which may compromise future implant placement in the edentulous site. Socket grafting is therefore frequently employed to preserve alveolar bone architecture, either as a standalone procedure or in combination with immediate implant placement. Despite its widespread use, the biological rationale underlying socket grafting remains incompletely understood and is often misconstrued. This review seeks to clarify the current evidence supporting socket grafting and to provide clinicians with a sound scientific basis for determining when and why this procedure should be recommended.

6- **Choukroun J et al (2006)** A new-generation platelet concentrate called platelet-rich fibrin (PRF) is made using a streamlined procedure that does not require biochemical blood manipulation. This paper connects the biological features of PRF with early clinical findings to determine its potential applications. The four main processes of wound healing—angiogenesis, immunological control, circulating stem cell entrapment, and epithelialization—are the foundation of the analysis. According to clinical data, PRF promotes efficient neovascularization, quick wound closure with better tissue remodelling, and a significantly lower risk of infection, all of which hasten tissue recovery. These results encourage the possible use of PRF in upcoming procedures like bone and plastic surgery, as long as its effects are assessed by thorough and objective research.

7- **Chen St et al (2004)** This article reviewed the literature on survival outcomes, clinical protocols, and results of immediate and delayed implant placement. A MEDLINE search (1990–June 2003) identified 31 eligible studies, most of which were short-term and nonrandomized. All studies reported implant survival, but none evaluated clinical success.

Peri-implant defects showed a strong capacity for bone regeneration. Horizontal defects ≤2 mm healed spontaneously with rough-surface implants, whereas larger defects or damaged socket walls required simultaneous grafting and membrane use. Delayed placement allowed infection resolution and improved soft tissue management but was associated with ridge resorption and increased augmentation needs. Overall, immediate and delayed implant placement demonstrated short-term survival rates comparable to implants placed in healed ridges, though long-term success data remain limited.

8- **Schropp L et al (2003)** Preservation of alveolar bone after tooth extraction is critical for optimal implant placement and esthetic–functional prosthetic outcomes. This study evaluated bone formation and dimensional changes of the alveolar ridge following premolar or molar extraction in 46 patients over a 12-month period using study cast measurements and radiographic analyses. The findings showed that the most significant dimensional changes at extraction sites occurred within the first year after tooth removal.

9- Lekovic V et al (1998) This study assessed the effectiveness of a bioabsorbable glycolide–lactide membrane for alveolar ridge preservation after tooth extraction using guided bone regeneration principles. Sixteen patients requiring extraction of two anterior teeth or premolars were treated using a split-mouth design. Experimental sites received membrane coverage following flap elevation and tooth extraction, while control sites were left untreated. Primary wound closure was achieved, and no membrane exposure occurred. At 6-month re-entry, sites treated with membranes showed significantly reduced vertical and horizontal bone loss and greater socket bone fill compared with controls. The findings indicate that glycolide–lactide bioabsorbable membranes are effective in preserving alveolar bone and minimizing ridge defects after extraction.

MATERIALS AND METHODS

STUDY DESIGN:

This prospective, clinical study shall encompass subjects requiring extraction of mandibular molars with two separate roots.

STUDYSETTING:

A total of 40 patients shall be reporting to the Department of Oral & Maxillofacial Surgery, M. M. College of Dental Sciences & Research, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala. The study shall proceed post due approval from the Institutional Research Review Board and Institutional Ethical Committee has been received.

Informed consents were taken from every patient who fulfilled the criteria and conditions listed below:

SELECTION CRITERIA:

INCLUSION CRITERA:

- Patients that can be classified into ASA - 1 category.
- The surgical sites must be free of active pathology.
- Patients who require extraction of mandibular molars with two separate roots.
- Patients between 18 – 60 years
- Patients showing willingness and providing consent for the procedure.
- Mandibular 1st and 2nd molars with two separate roots.

EXCLUSION CRITERIA:

- Patients having a history of connective tissue disorders and/or bleeding disorders.
- Active pathology associated with the affected tooth/teeth.

- Patients who have uncontrolled diseases of a systemic nature that can interfere with healing.
- Patients with known allergy to the local anaesthetic solution.
- Patients who have a history of or are undergoing any radiation in the head and neck region.
- Patients with history of medications that may interfere with the outcomes of the study.
- Pregnant and lactating women.
- Patients who consume tobacco, alcohol and narcotics.
- Patients not willing to be part of the study.
- Mandibular 3rd molars.
- Mandibular 1st and 2nd molars with fused roots.

STUDY MATERIAL:

- PRF – Blood sample for obtaining PRF shall be taken in the presence of blood bank personnel.
- Collagen Plug (Type I Collagen derived from bovine Achille's tendon by Coloplug, Cologenesis Pvt. Ltd.)
  Sites will be divided into site A & site B

In Site A, Collagen plug will be placed after extraction in the socket.

In Site B, PRF with Collagen Plug will be placed after extraction in the socket.

ARMAMENTRIUM:

- Diagnostic instruments – Dental probe, mouth mirror, tweezer.
- Disposable 5cc syringe.
- Disposable 10cc syringe.
- Centrifuge machine.
- LA with adrenaline bitartrate (1:200000).

- Extraction instruments – Molt's no. 09 Periosteal elevator, extraction forceps for mandibular posterior teeth.
- Sterile Gauze pieces.
- Collagen plug.
- 3-0 Silk suture.
- Needle holder.
- Suture cutting scissors.

PREOPERATIVE INVESTIGATIONS –

- A pre-extraction intraoral periapical (IOPA) radiograph shall be taken to assess whether the molar has two separate roots or fused roots. Molars with fused roots will be excluded from the study.
- Routine blood investigations.
- Post extraction IOPA to assess if there is a thick interradicular bone separating the two root sockets; also, to check equal bone height in both the sockets. If there is less or no interradicular bone or unequal bone height, it will be excluded from the study.

Procedure for preparation of PRF -

- 1. 10 ml of Blood sample will be withdrawn from the patients under aseptic conditions and deposited in 15ml sterile test tubes devoid of anti-coagulants.
- 2. Withdrawn blood sample will be centrifuged at 3000 rpm for 12 minutes (Remi Medico Plus).
- 3. The fibrin clot (PRF) was then formed at the middle part of sample in the tube, just between the red blood cells which settle at the bottom of the test tube and the platelet poor plasma.

SURGICAL PROCEDURE:

- The local anaesthetic solution, 2% lignocaine hydrochloride with adrenaline bitartrate (1:200000), which will be used after sensitivity testing.
- Subjective and objective signs will be checked.
- Selected teeth and/or root stumps would be extracted using appropriate elevators/forceps.
- Lucas curette was used to remove any debris, tooth remnants.
- Any irregular bony edges were smoothened using a bone file.
- The socket will then be thoroughly cleaned with betadine and normal saline.
- In one root (Site – A) Collagen plug will be placed & in the other root (Site – B) PRF along with collagen plug will be placed.
- Site A & B mesial or distal will be selected by coin toss method.
- Primary closure of the wound shall be achieved with 3-0 silk sutures.
- The oral cavity will then be irrigated with betadine and normal saline.
- A sterilized gauze pack will be placed on wound site.
- Patients were prescribed antibiotics and analgesics twice daily for 5 days and chlorhexidine gluconate mouthwash (0.12%) will be prescribed in (1:4 dilution), 4 times a day for 7 days.
- Suture removal shall be done on the 7^{th} post - operative day.
- Patients will be called for further follow up on 1^{st}, 3^{rd} and 7^{th} post – operative days for clinical evaluation of the socket.
- Suture removal shall be done on the 7^{th} post-operative day.

POST OPERATIVE EVALUATION PARAMETERS

POST-OPERATIVE EVALUATION PARAMETERS -

Both the groups will be evaluated on the basis of the following parameters.

RADIOLOGICAL PARAMETERS –

- **BONE HEIGHT:** Height of the newly formed bone will be evaluated radiographically by measuring the distance between the inferior-most part of the till the highest point of the socket. The values shall be recorded postoperatively at the 3rd month using NNT software of the digital imaging machine – CBCT (NEWTOM, HR).

- **BONE WIDTH:** Bone width shall be measured in two aspects – mesiodistal and buccolingual, thereby making it easing the comparison of remineralisation in the said aspects. The values shall be measured postoperatively at the 3rd month using the NNT software of the CBCT machine (NEWTOM, HR).

- **BONE DENSITY:** Density of regenerated bone will be assessed and measured radiographically at the 3rd month postoperatively using NNT software of the digital imaging machine- CBCT (NEWTOM, HR).

- **TRABECULAR PATTERN:** was assessed independently by three expert oral radiologists from the CBCT of the patient done at the 3rd month, via the method advised by Kelly et al.

TECHNIQUE: The radiologists shall examine the slices of the defect in all three axes and scored the regenerate according to following scoring system.

3- All trabeculae are substantially coarse.

2- Mostly coarse and some are fine trabeculae.

1- Delicate, finely meshed trabeculae.

0- Granular, nearly homogenous patterns; individual trabeculae essentially absent.

CLINICAL SIGNIFICANCE

To achieve the best possible functional and aesthetic results, alveolar ridge proportions must be preserved after tooth extraction for future implant placement.

Collagen plug has become a material of interest as it has proven to be useful in the preservation of alveolar sockets. It prevents intrusion of soft tissue into the socket, therefore proving to be an aid in maintaining the dimensions of the socket. This type of collagen helps in clot stabilisation and protects the wound postoperatively.

Combining Collagen plug with PRF in socket preservation will enhance the regeneration capacities Collagen plug which might lead to better results.

In order to assist clinicians in choosing an affordable, biologically safe, and reliable socket preservation method, this study attempts to present clinical and radiographic data comparing Collagen plug vs PRF paired with a collagen plug.

Conflict of interest: None

Sponsorship: Self

Copyright infringement: None

Risk of subjects: None

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PATIENT INFORMED CONSENT FORM

Title of the project: "**Comparative Evaluation Of The Effectiveness Of Collagen Plug vs PRF With Collagen Plug In Alveolar Socket Preservation**"

I have been informed of the purpose of the procedure and how it will benefit my treatment. The procedure has been described to me and I understand how it will be accomplished. The nature, objective, duration and expected effects of the study have been explained to me in a language in which I am conversant. I had the time and opportunity to enquire about the study and I have been fully satisfied with the

explanations given.

•I am ready to participate voluntarily in this study.

•I understand that I am at liberty to withdraw from this study at any time without justifying my decision to withdraw.

- I know that the results from this study may be forwarded to the suitable authorities, presented in scientific meetings and published.
- By signing this consent form, I have not given up any legal rights which I am otherwise entitled to as subject in this study.

•I know that I will be given a copy of this consent form which is signed and dated.

Signature of the participant:_____Date:

Signature of the witness:_____Date:

Signature of the investigator:_____Date

Synopsis_1725707_Kotian Swati Sharathkumar

ORIGINALITY REPORT

8%	%	8%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Sayed Rashed, Ahmed Elsharkawy, Amira Zaied, Ali Fahd. "Efficacy of Autologous Leucocyte-Platelet-rich Fibrin (L-PRF) versus Hydroxyapatite as a Graft Material for Socket Healing after Surgical Extraction of Impacted Mandibular Third Molars: A Comparative Clinical and Radiographic study", Egyptian Dental Journal, 2019 Publication	2%
2	Ullah, H. Shakeeb. "Comparison of the Efficacy of a Combination of Platelet Rich Fibrin and Biograft- Ht® with that of Platelet Rich Fibrin Alone in Healing of Mandibular Third Molar Sockets - A Prospective Clinical Study", Rajiv Gandhi University of Health Sciences (India), 2023 Publication	1%
3	Dinesh Kumar, Deepika Patidar, Aayush Malhotra, Nikita Suri, Dinesh Chand Patidar, Ramesh Ram Fry. "Evaluation of Hemodynamic Changes in Third Molar Surgery: An Observational Study", Dental Journal of Advance Studies, 2023 Publication	1%
4	Ahmed, Nida. "Efficacy of Prf Versus Prf+Biodegradable Collagen Plug in Socket Preservation After Extraction-A Comparitive	1%

	Clinical and Radiographic Study", Rajiv Gandhi University of Health Sciences (India), 2023 Publication	
5	Hend D. Gamil, Samia A. Ibrahim, Howyda M. Ebrahim, Waleed Albalat. "Platelet-Rich Plasma Versus Tretinoin in Treatment of Striae Distensae", Dermatologic Surgery, 2018 Publication	<1 %
6	Patange, Amit. "Efficacy of Scalpel Excision and Platelet Rich Fibrin Membrane as Bio-Active Dressing on Oral Mucosal Excision Sites", Rajiv Gandhi University of Health Sciences (India), 2023 Publication	<1 %
7	Rahmi Amtha, Ferry Sandra, Rosalina Tjandrawinata, Indrayadi Gunardi, Anggraeny Putri Sekar Palupi. "Current Research and Trends in Dental and Medical Technology", CRC Press, 2025 Publication	<1 %
8	"Dental Ultrasound in Periodontology and Implantology", Springer Science and Business Media LLC, 2021 Publication	<1 %
9	Chung-Hung Tsai, Shih-Ya Shen, Jiing-Huei Zhao, Yu-Chao Chang. "Platelet-rich fibrin modulates cell proliferation of human periodontally related cells in vitro", Journal of Dental Sciences, 2009 Publication	<1 %
10	Najar, Sivan. "Healing Potential of Platelet-Rich Fibrin in Third Molar Sockets on Both Simple and Surgical Extractions With Preservation of Soft Tissue Healing and	<1 %

Postoperative Complaints", Lithuanian University of Health Sciences (Lithuania), 2024
Publication

11	Rosal D. Salman, Salwan Y. Bede. "The Use of Osseodensification for Ridge Expansion and Dental Implant Placement in Narrow Alveolar Ridges: A Prospective Observational Clinical Study", Journal of Craniofacial Surgery, 2022 Publication	<1 %
12	Amirabbas Rastegar, Mahboobeh Mahmoodi, Mohammad Mirjalili, Navid Nasirizadeh. "Platelet-rich fibrin-loaded PCL/chitosan core-shell fibers scaffold for enhanced osteogenic differentiation of mesenchymal stem cells", Carbohydrate Polymers, 2021 Publication	<1 %
13	Baldissara, P.. "Use of carbon-epoxy frameworks for reinforcing provisional fixed partial dentures", The Journal of Prosthetic Dentistry, 200401 Publication	<1 %
14	Giovanni Della Valle, Maria Chiara Alterisio, Jacopo Guccione, Chiara Caterino et al. "New Frontiers in Regenerative Medicine: Protocol Standardization and Morphological Assessment of Leukocyte-Platelet Rich Fibrin in Cows, with a Longitudinal Study on Growth Factor Release Dynamics", Veterinary and Animal Science, 2025 Publication	<1 %
15	R. Vinaya Kumar, N. Shubhashini. "Platelet rich fibrin: a new paradigm in periodontal regeneration", Cell and Tissue Banking, 2012 Publication	<1 %